

Unit

15

Environmental Chemistry

II Water

Long Answer Questions

Q.1 Write the physical properties of water.

Ans. Physical properties of water:

Water is composed of two elements: oxygen and hydrogen. One atom of oxygen combines with two atoms of hydrogen to form one molecule of water. Pure water is a clear, colourless, odourless and tasteless liquid with following properties:

- (i) It is neutral to litmus.
- (ii) Its freezing point is 0°C and boiling point is 100°C at sea level.
- (iii) Its maximum density is 1 g cm^{-3} at 40°C .
- (iv) It is excellent solvent for ionic as well as molecular compounds.
- (v) It has unusually high that of heat capacity about $4.2 \text{ J g}^{-1}\text{K}^{-1}$, which is about six times greater than that of rocks. This specific property of water is responsible for keeping the Earth's temperature within limits. Otherwise, day time temperature would have been too high to bear and night time temperature would have been too low to freeze everything.
- (vi) It has high surface tension. This unique property of water is responsible for its high capillary action. Capillary action is the process by which water rises up from the roots of plants to leaves. This process is vital for the survival of the land plants.

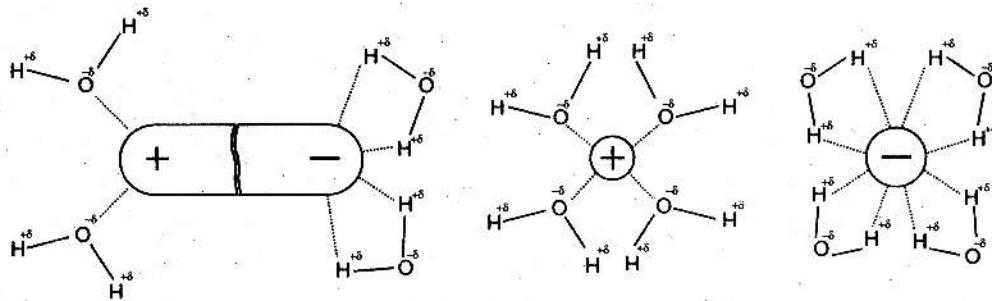
Q.2 How polarity of water molecule plays its role to dissolve the substance?

Ans. Polar nature of water

Water molecule has a polar structure, i.e., one end of the molecule is partially positive while the other end is partially negative because of electronegativity difference between oxygen and hydrogen atoms.

All other polar substances are soluble in water, because the positive $\text{H}^{\delta+}$ end of the substance is attracted by the negative end ($\text{O}^{\delta-}$) of the water and negative end of the substance is attracted by the positive end ($\text{H}^{\delta+}$) of the water. The electrostatic attraction among the ions are overcome by the ion-dipole forces of attraction between ion and water

molecules. In this way positive and negative ions of the compounds are pulled apart as shown in figure 15.1. Ultimately, these oppositely charged ions are most of the salts like NaCl, KCl, Na₂SO₄, etc., are soluble in water.



On the other hand, many covalent substances like benzene, ether, octane, etc., which do not have polar ends or bonds are not attracted by water molecules. Therefore, non-polar compounds do not dissolve in water.

Q.3 Explain the water pollution because of industrial waste.

Ans. Industrial units are installed to produce the desired substances (chemicals, cloth, leather goods, paper, plastic items, petrochemicals and rubber items) on commercial scale to meet the needs of the society. But unfortunately all the industrial units discharge their wastes (chemicals and solid materials) either to open ground or to water channels. This is called industrial effluent. The industrial effluent may be highly toxic organic chemicals, inorganic salts, heavy metals, mineral acids, oil and grease, etc. On the other hand, water used as cleaning agent in industries is directly discharged out. This water contains all kinds of toxic chemicals and detergents.

When these effluents or used water enter lakes, streams, rivers or oceans, they either get dissolved or float suspended in water. Even they get deposited on the bed. This results in the pollution of water, i.e.,

- They deteriorate the quality of water.
- They reduce the quantity of dissolved oxygen, ultimately affects aquatic life and ecosystem.
- They can also seep down and affect the ground water deposits. They contaminate the water deposits. When this water is used by human beings it causes serious diseases like cancer and gastro. This polluted water damage soil, plants and animals.
- Heavy metals like cadmium, lead and mercury are toxic and health hazards for human beings. Acute cadmium poisoning causes high blood pressure, kidney damage and destruction of red blood cells. Acute lead poisoning causes

dysfunction of kidney, liver, brain, central nervous system and reproduction system. Mercury poisoning causes neurological damage.

Q.4 Justify the statement house hold water is the reason of water pollution.

Ans. Use of detergents is increasing day by day for cleaning purposes in houses and industries. It is because, detergents have strong cleaning action than that of soap even in hard water. They can work even in acidic solutions. But they have a major disadvantage over the soaps, as some of the detergents are non-biodegradable (cannot be decomposed by micro-organisms like bacteria). When household water containing these detergents is discharged in streams, ponds, lakes and rivers, it causes water pollution.

The detergent remains in the water for a long time and makes the water unfit for aquatic life. The phosphate salts present in detergents cause rapid growth of algae in water bodies, which floats over the surface of water. These plants ultimately die and decay. Decaying plants being bio-degradable consume O_2 present in water. Thus, depletion of O_2 results in death of aquatic life.

Domestic sewage contains a wide variety of dissolved and suspended impurities. They include food and vegetable waste, garbage, cans, bottles, chemical soaps, washing powder, etc. It also contains disease causing microbes. All these substances add to water pollution.

Q.5 Explain agricultural effluents are fatal for aquatic life.

Ans. Water pollution due to agricultural waste is because of use of fertilizers and pesticides. Fertilizers are used to make up the deficiency of nitrogen, phosphorus, etc., of the soil because of intensive cultivation of crops in the recent years.

On the other hand, pesticides are used either directly to kill or control the growth of pests. Pests may be weeds, herbs, insects, fungi, viruses, etc. They all damage crops and transmit diseases both to human beings and animals.

Run-off from the agricultural land (where fertilizer and pesticides have been used) enters into ponds, streams or rivers. This water contains nitrate NO_3^- and phosphate PO_4^{3-} salts. These substances result in a rapid growth of algae, floating over the surface of water. They prevent the sunlight and air (oxygen) to reach up to aquatic life. When algae dies, and decompose bacteria consume oxygen of the water for decomposition. As a result oxygen depletes in the water. Aquatic animals feel suffocation and ultimately die due to insufficient supply of oxygen.

Q.6 What are waterborne infectious diseases? Explain any four waterborne diseases

Ans. Diseases that spread because of drinking polluted water or eating food prepared with polluted water are called water borne diseases. Water pollution may be due to toxins or

microorganisms. Toxins are arsenic, mercury, arsenic, lead and many organic chemicals. Microorganisms are viruses, bacteria, protozoa and worms.

Lack of proper sanitation facilities is the main cause of rapidly spreading waterborne diseases. A few common diseases are mentioned here:

Diarrheal disease

Intestinal diseases, such as cholera, that may cause dangerous dehydration. Diarrhea may be caused by viruses, bacteria, or parasites.

Dysentery

Dysentery is an intestinal disease which is typically caused by certain bacteria or parasites. It is characterized by severe diarrhea that may be accompanied by blood or mucous.

Cholera

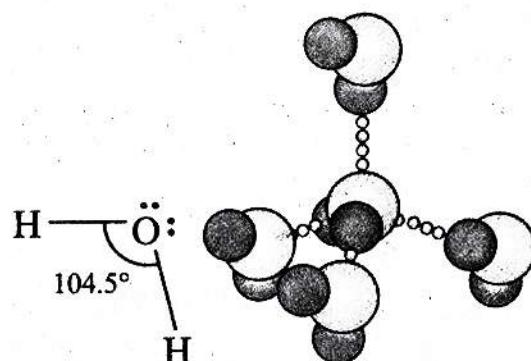
Cholera is an acute infection caused by the bacteria Vibrios cholera, which may be found in water contaminated by human feaces. Cholera causes severe diarrhea and can be fatal.

Cryptosporidium

Waterborne micro-organism (protozoa) that causes gastrointestinal illness (cryptosporidiosis) including diarrhea and vomiting. These tiny pathogens are found in surface water sources like reservoirs, lakes, and rivers.

Q.7 Explain hydrogen bonding in water molecule?

Ans. Water molecule is composed of oxygen and hydrogen atoms. Because of two O-H bonds and two lone pairs, one H₂O molecule can form hydrogen bonding with four other H₂O molecules, which are arranged like tetrahedral around the H₂O molecule as shown in Figure. This unique behaviour of water enables it to dissolve many polar non-ionic compounds having hydroxyl group (-OH), like alcohols, organic acids, glucose, sugar, etc. by forming hydrogen bonds with them.



Hydrogen bonding of water molecule

Q.8 Write disadvantages of hard water?

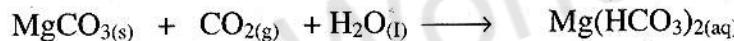
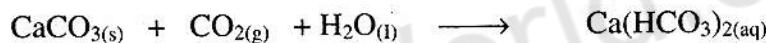
Ans. Following are some of the disadvantages of hard water:

- i. Hard water consumes large amount of soap in washing purposes.
- ii. Drinking hard water causes stomach disorders.
- iii. Hard water is unfit for use in steam engines, boilers and turbines because insoluble calcium and magnesium salts are deposited inside. Which is called scales. They are bad conductors of heat and hence more fuel is used. Insoluble calcium and magnesium sulphates not only reduce the efficiency of the engine but also cause the boiler to burst.

Q.9 How hardness in water is caused? Explain

Ans. The rain water while coming down absorbs carbon dioxide from the atmosphere. The water mixed with carbon dioxide, when passes through the beds of the soil, converts insoluble carbonates of calcium and magnesium into soluble bicarbonates. It may also dissolve chlorides and sulphates of calcium and magnesium.

These salts make the water hard.



Thus, rain water dissolves many salts of divalent cations like Mg^{2+} , Ca^{2+} , and anions like Cl^- , SO_4^{2-} , HCO_3^- and CO_3^{2-} for example, gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) and limestone (CaCO_3). These salts make the water hard.

Gypsum is sparingly soluble in water, while limestone is insoluble in water. However, in the presence of carbon dioxide small quantity of limestone is soluble in water according to the above chemical reaction.

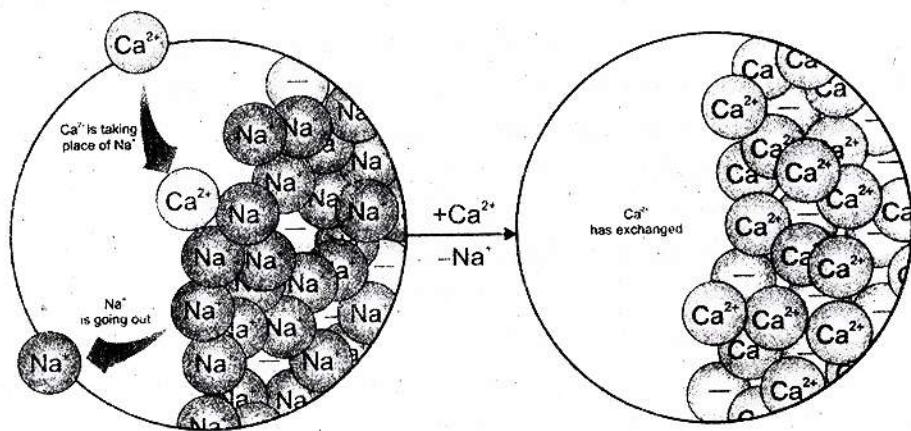
Q.10 How permanent hardness is removed by using sodium zeolite?

Ans. Using sodium Zeolite (an ion Exchanger) Sodium zeolite is a naturally occurring resin of sodium aluminium silicate $\text{NaAl}(\text{SiO}_3)_2$, which can also be prepared artificially. It is used for softening of water at domestic as well as on industrial scale. When water is passed through resin sodium ions of the resin are exchanged with the unwanted calcium and magnesium ions of the hard water as shown in figure



When resin is fully used up it can be regenerated by flushing it with concentrated solution of NaCl . The reverse process take place because of high concentration of sodium ions.

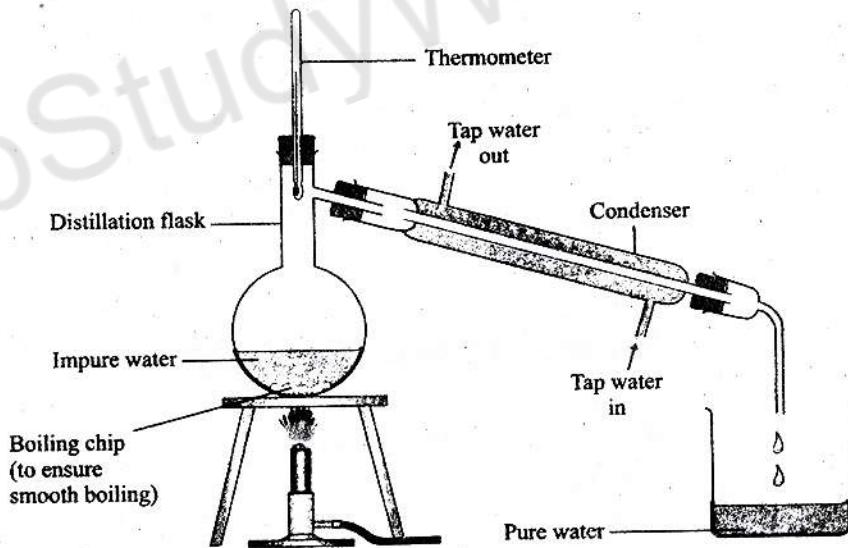




Ion exchange for removal of hard water ions

Q.12 How impure water is purified by distillation process?

Ans. Impure water can be purified by simple distillation apparatus as shown in figure. Distillation process involves boiling of a liquid and then condensing the vapours. Impure water is taken in a distillation flask. It is boiled. Water vapours rise and enter the condenser. The vapours condense while passing through condenser. Thus, they are changed back into pure water, which is called distillate (distilled water). The distillate is collected in a beaker.



Q.13 What are the effects of water pollution explain?

Ans. Following are some of the effects of water pollution:

- It is hazardous to human health. Drinking polluted water can cause cholera, typhoid and diarrhea.
- The use of polluted water is not only devastating for people but also for animals and birds.

- iii. It causes It cause rapid growth of algae. Death and decomposition of algae cause deficiency of oxygen in water that affects other organism living in water.
- iv. It is damaging aquatic life, thus breaking a link in food chain.
- v. It reduces the aesthetic quality of lakes and rivers.
- vi. It is unfit for cleaning or washing purposes.

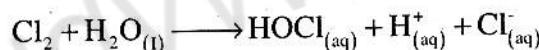
Q.14 How waterborne diseases can be prevented?

Ans. Waterborne diseases can be prevented by taking the following measures:

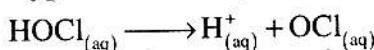
- i. Provision of safe water: Drinking water must be properly treated and purified.
- ii. Disposal of sewage: There must be adequate sanitary disposal of sewage. Any type of waste must not be thrown or discharged directly in water supplies or reservoirs.
- iii. Control of toxic chemicals: Chemical contamination can cause acute illness, but often toxic contaminants are slow poisons and carcinogens. There must be a strict control over the use of pesticides and other chemicals.

Q.15 Explain the chemistry of swimming pool cleanliness?

Ans. Swimming pools are cleaned by chlorination process. It is the addition of chlorine solution in swimming pools. Chlorine kills bacteria and other micro-organisms. Cl_2 itself does not kill rather it dissociate in water to form hypochlorous acid (HOCl) and hydrochloric acid.



HOCl further ionizes to produce hypochlorite and proton



Both the products HOCl and OCl^- kill bacteria and micro-organisms.

Short Answer Questions

Q.1 Why water is considered to be universal solvent?

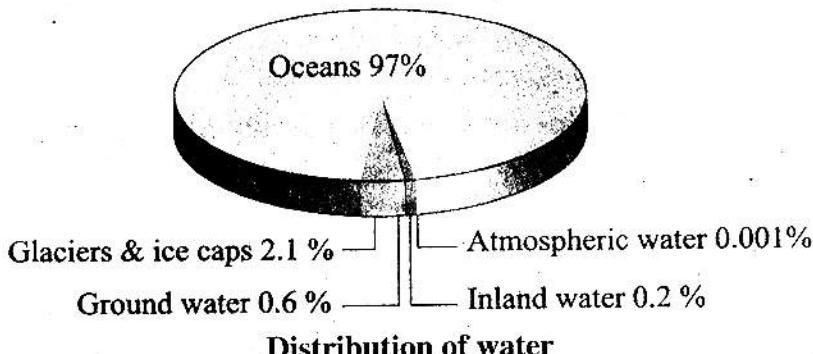
Ans. Water is the universal solvent because it can dissolve almost all the minerals. Its ability to dissolve substances is because of two unique properties of water.

- (i) Polarity of water molecule.
- (ii) Exceptional hydrogen bonding ability.

Q.2 Write occurrence of water?

Ans. The oceans contain about 97% of world water. The rest of the water is in the form of glaciers, ice caps, ground water and inland water (river, lakes, and steams). It is also present

in atmosphere in the form of water vapours.



Distribution of water

Q.3 Why sea water is unfit for drinking purpose?

Ans. Sea water is unfit for drinking and agricultural purposes due to high percentage of dissolved salts. Only 20.2% of the total water on the Earth is potable, i.e. fit for drinking purposes.

Q.4 What happen if you add lump of cesium to water?

Ans. If you add a lump of cesium to water in a glass trough, the reaction is so vigorous that the trough will shatter into small pieces.

Q.5 How fluorine is beneficial for life?

Ans. In some parts of the world, the water supply contains small amounts of fluorine compounds. It was found that, in these areas, people did not suffer much from tooth decay. This is because compounds of fluorine protect teeth from decay. This is why many tooth pastes contain fluorine compounds.

Q.6 How hard water hampers the cleanings action of soap?

Ans. Soap is the sodium salt of a long chain carboxylic acid (fatty acid). Hard water contains salts of magnesium and calcium. These ions react with the soap molecule to form an insoluble precipitate of calcium and magnesium salts of fatty acids called scum. As a result, a large amount of soap is wasted in scum formation. Thus, it reduces the efficiency of soap.

Q.7 What is meant by water pollution?

Ans. Water pollution is a contamination of water bodies (e.g. lakes, rivers, oceans and ground water). Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds.

Q.8 What is the difference between soft and hard water?

Ans. **Soft water:** Soft water is that produces good lather with soap.

Hard water: Hard water is that which does not produce lather with soap.

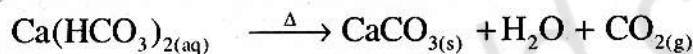
Q.9 What are the types of hardness in water?

Ans.

- i. **Temporary hardness** is because of presence of bicarbonates of calcium and magnesium.
- ii. **Permanent hardness** is because of presence of sulphates and chlorides of calcium and magnesium.

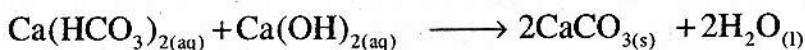
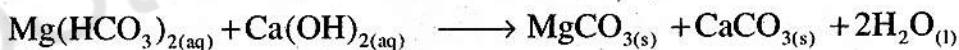
Q.10 How temporary hardness is removed by boiling method?

Ans. Temporary hardness of water is easily removed by boiling water. On boiling calcium bicarbonate $\text{Ca}(\text{HCO}_3)_2$ decomposes to produce insoluble calcium carbonate, which precipitates out of the solution.



Q.11 How temporary hardness is removed by Clark's method?

A chemical method to remove temporary hardness is by the addition of slaked lime $\text{Ca}(\text{OH})_2$. A calculated amount of lime water is added to temporary hard water.



Thus once the magnesium and calcium ions precipitate out water becomes soft.

Q.12 What is hepatitis?

Ans. It is liver inflammation commonly caused by one of five viruses called hepatitis A,B,C,D and E. Hepatitis A and E can be transmitted by contaminated water.

Q.13 What is the importance of water in our daily life?

Ans. Its importance is because of two reasons. Firstly, it is an essential and major component of each and every living cell. For example, human body consists of about 70% water. Secondly, it provides an environment for animals, and plants that live in water. So, all living organisms owe their life because of water.

Q.14 Write characteristics of pure water?

Ans. Good quality water is colourless, odourless and tasteless. Hardness of water can be checked by washing. Soft water produces lather with water. Pure water has least conductivity.

Q.15 What are the industrial effluents of water pollution?

Ans. Industrial effluents are one of the main causes of water pollution. It includes high toxic organic chemicals, inorganic salts, heavy metals, mineral acids, oil and greases, etc.

Q.16 What is meant by water borne diseases? How they are controlled?

Ans. Waterborne diseases are those diseases that spread because of drinking polluted water. These diseases spread because of lack of proper sanitation arrangements. These diseases can be prevented by using safe water, properly disposing sewage and controlled use of toxic chemicals.

Q.17 What is the effect of detergents on scarcity of oxygen?

Ans. Household water in the sewage from toilets, baths, kitchens, etc. consists of detergents used for cleaning purposes. Detergent being non-biodegradable causes rapid growth of aquatic plants. When these plants die and decay, they consume O_2 present in the water. Thus, aquatic life is badly affected because of scarcity of O_2 .

Q.18 Write a short note on agricultural effluents?

Ans. Agricultural effluents consist of fertilizers and pesticides. These substances provide nitrate and phosphate ions for rapid growth of aquatic plants. When these plants die and decay, their decomposition process consumes O_2 of water. Thus, depletion of O_2 causes damage to the aquatic life.

Q.19 What is meant by fluorosis?

Ans. Fluorosis is a disease caused by the consumption of excess fluoride. Fluorosis can cause bones and teeth damage.

Q.20 Give composition of water molecule.

Ans. Water is composed of two elements: oxygen and hydrogen. One atom of oxygen combines with two atoms of hydrogen to form one molecule of water.

Q.21 What is hepatitis?

Ans. It is liver inflammation commonly caused by one of five viruses called hepatitis A, B,

C, D, and E, Hepatitis A and E can be transmitted by contaminated water.

Q.22 Write the role of hookworm in causing waterborne disease.

Ans. Hookworm is a parasitic worm that infects the small intestine. Severe cases can result in anemia and stunted growth in children. Hookworm larvae enter the body through the skin, often via the feet. Spread by poor sanitary conditions, hookworms infect about one billion people worldwide per annum.

Q.23 How Jaundice is caused?

Ans. Jaundice is caused by an excess of bile pigments in the blood. Liver ceases to function and eyes turn yellow. Patient feels weakness and fatigue.

Q.24 How typhoid is caused?

Ans. A dangerous bacterial disease often spread by contaminated water or by food prepared with contaminated water.

Q.25 What is meant by water softening?

Ans. The removal of Mg^{2+} and Ca^{2+} ions which are responsible for the hardness is called water softening.

Q.26 What is Capillary action?

Ans. Capillary action is the process by which water rises up from the roots of plants to leaves.

This process is vital for survival of land plants.

Q.27 Point out two properties of water that makes it an excellent solvent.

Ans. The ability of water to dissolve substances is because of two unique properties which are given below.

- (1) Polarity of water molecule.
- (2) Exceptional hydrogen bonding ability.

Q.28 Why the water molecule is polar?

Ans. Polar nature of Water: Water molecule has a polar structure i.e., one end of the molecule is partially positive while the other end is partially negative because of electronegativity difference between oxygen and hydrogen atoms.

Q.29 Explain why non-polar gases are soluble in water?

Ans. Water can even dissolve non-polar (un-ionizable) gases like oxygen, hydrogen and nitrogen etc. through dipole-induced dipole forces.

Q.30 Which salts are responsible for hardness of water?

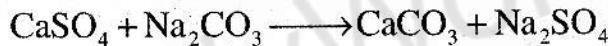
Ans. Rain water dissolves many salts of divalent cations like Mg^{+2} , Ca^{+2} , and anions like Cl^{-1} , SO_4^{-2} , HCO_3^- and CO_3^{-2} . For example, gypsum ($CaSO_4 \cdot 2H_2O$) and lime stone ($CaCO_3$). These salts make the water hard.

Q.31 What is the principle of removing permanent hardness of water?

Ans. The permanent hardness can only be removed by using chemicals calcium (Ca^{+2}) and magnesium (Mg^{+2}) are removed as “Insoluble salts” by adding washing soda (Na_2CO_3) or sodium zeolite.

Q.32 How addition of Na_2CO_3 removes permanent hardness of water?

Ans. The addition of washing soda removes the calcium and magnesium ions as the insoluble calcium and magnesium carbonate respectively.



Q.33 How sodium zeolite softens water?

Ans. Sodium zeolite is a naturally occurring resin of sodium aluminium silicate $NaAl(SiO_3)_2$, which can also be prepared artificially. When water is passed through resin sodium ions of the resin are exchanged with the unwanted calcium and magnesium ions of the hard water.



Q.34 What do you mean by boiler scales? How are they removed?

Ans. Hard water is unfit for use in steam engines, boilers and turbines because insoluble calcium and magnesium salts are deposited inside. This hard deposited layer of calcium and magnesium salts is called as boiler scale, they can be removed by washing the boilers with washing soda, slaked lime and sodium zeolite.

Q.35 What is an industrial waste?

Ans. All the industrial units discharge their wastes (chemical and solid materials) either to open ground or to water channels this is called industrial effluent.

Q.36 How water used as a cleaning agent in industries cause pollution?

Ans. Water used as cleaning agent in industries is directly discharged out. This water contains all kinds of toxic chemicals and detergents.

When these effluents or used water enter lakes, streams, rivers or oceans, they either get dissolved or float suspended in water. Even they get deposited on the bed. This results in pollution of water.

Q.37 Why use of detergents is increasing day by day?

Ans. The use of detergents is increasing in houses and industries because detergents have strong cleaning action that of soap even in hard water. They can even work in acidic solution.

Q.38 How decaying plants consume oxygen?

Ans. Decaying plants consume oxygen for the biodegradable.

Q.39 What is function of fertilizers?

Ans. Fertilizers are used to make up the deficiency of nitrogen, phosphorous etc. of the soil because of intensive cultivation of crops in the recent years.

Q.40 How pesticides cause water pollution?

Ans. Run-off from the agricultural land (where fertilizer and pesticides have been used) enters into ponds, streams or rivers. This water contains nitrate (NO_3^{-1}) and phosphate (PO_4^{3-}) salts. These substances results in a rapid sunlight and air to reach the aquatic life.

When algae dies and decompose, bacteria consume oxygen of the water for decomposition. As a result, oxygen depletes in water. Aquatic animals feel suffocation and ultimately die due to insufficient supply of oxygen.

In this way, pesticides play their role in water pollution.

Q.41 Define water borne diseases.

Ans. Diseases that spread because of drinking polluted water or eating food prepared with polluted water are called water borne diseases.

Q.42 What is dysentery?

Ans. Dysentery is an intestinal disease which is typically caused by certain bacteria or parasites. It is characterized by severe diarrhea that may be accompanied by blood or mucous.

Q.43 Which of the bacteria causes the cholera?

Ans. Bacteria vibrio cholera causes cholera.

Multiple Choice Questions

1. Which one of the properties of water is responsible for rising of water plants?

- (a) specific heat capacity
- (b) surface tension
- (c) excellent solvent action
- (d) capillary action

2. Specific heat capacity of water is

- (a) $4.2 \text{ kJg}^{-1}\text{K}^{-1}$
- (b) $4.2 \text{ Jg}^{-1}\text{K}^{-1}$
- (c) $2.4 \text{ KJg}^{-1}\text{K}^{-1}$
- (d) $2.4 \text{ Jg}^{-1}\text{K}^{-1}$

3. Water dissolves non-ionic compound by

- (a) ion-ion forces
- (b) ion-dipole forces
- (c) dipole –dipole forces
- (d) hydrogen bonding

4. Temporary hardness is because of

- (a) $\text{Ca}(\text{HCO}_3)_2$
- (b) CaCO_3
- (c) MgCO_3
- (d) MgSO_4

5. Temporary hardness is removed by adding

- (a) quick lime
- (b) slaked lime
- (c) lime stone
- (d) lime water

6. Permanent hardness is removed by adding

- (a) $\text{Na}_2\text{zeolite}$
- (b) soda lime
- (c) lime water
- (d) quick lime

7. Which one of the following salts makes the water permanently hard?

- (a) NaCO_3
- (b) NaHCO_3
- (c) $\text{Ca}(\text{HCO}_3)_2$
- (d) CaSO_4

8. Rapid growth of algae in water bodies is because of detergent having

- (a) carbonate salts
- (b) sulphonate acid salts
- (c) sulphate salts
- (d) phosphate salts

9. Which one of the following is not a reason of depletion of O_2 from water

- (a) decaying of aquatic plants
- (b) biodegradation of aquatic plants
- (c) sulphate salts
- (d) phosphate salts

10. Which one of the following diseases causes liver inflammation?

- (a) typhoid
- (b) jaundice
- (c) cholera
- (d) hepatitis

11. Which one of the following diseases causes severe diarrhea and can be fatal?

- (a) jaundice
- (b) dysentery
- (c) cholera
- (d) typhoid

12. Which one of the following gases is used to destroy harmful bacteria in water?

- (a) iodine
- (b) chlorine
- (c) fluorine
- (d) bromine

13. The percentage of water in human body is

- (a) 40%
- (b) 50%
- (c) 60%
- (d) 70%

14. The percentage of oceans in world water is

- (a) 50%
- (b) 67%
- (c) 97%
- (d) 25%

15. Inland water includes

- (a) River
- (b) Lakes
- (c) Streams
- (d) All of them

16. Sea water is unfit for drinking purpose due to the presence of

- (a) Salts
- (b) Algae
- (c) Fishes
- (d) All of them

17. The percentage of potable water on earth is

- (a) 2%
- (b) 0.2%
- (c) 0.02%
- (d) 0.002%

18. The freezing point of water is

- (a) 10°C
- (b) 100°C
- (c) 0°C
- (d) 46°C

19. The boiling point of water is

- (a) 100°C
- (b) 4°C
- (c) 0°C
- (d) 25°C

20. Water has a maximum density at

- (a) 10°C
- (b) 0°C
- (c) 4°C
- (d) 100°C

21. The heat capacity of water is

- (a) $4.2 \text{ J g}^{-1}\text{k}^{-1}$
- (b) $2.1 \text{ J g}^{-1}\text{k}^{-1}$
- (c) $3.2 \text{ J g}^{-1}\text{k}^{-1}$
- (d) $5.9 \text{ J g}^{-1}\text{k}^{-1}$

22. Water has a maximum density at 4°C

- (a) 12 cm^{-3}
- (b) 2 g cm^{-3}
- (c) 1 g cm^{-3}
- (d) 4 g cm^{-3}

23. How many times the heat capacity of water is greater than that of rocks.

- (a) two
- (b) three
- (c) four
- (d) Six

24. The process by which water rises up from the roots of plants to leaves is called

- (a) Photosynthesis
- (b) Respiration
- (c) Surface tension
- (d) Capillary action

25. Which of the following salt is soluble in water?

- (a) NaCl
- (b) KCl
- (c) Na_2SO_4
- (d) All of them

26. Which of the following is insoluble in water?

- (a) Benzene
- (b) NaCl
- (c) KCl
- (d) All of them

27. One H_2O molecule can form hydrogen bonding with how many other H_2O molecules?

- (a) One
- (b) Two
- (c) Three
- (d) Four

28. Water molecules show structure

- (a) Tetrahedral
- (b) Trigonal
- (c) Pentagonal
- (d)

29. Some organic compounds are soluble in water due to the presence of

- (a) -OH
- (b) H^+
- (c) both a and b
- (d) covalent bond

30. Which of the following is soluble in water?

- (a) Organic acids
- (b) glucose
- (c) alcohols
- (d) all of them

31. Water which produces good lather with soap is called

31. (a) Soft water (b) Hard water
(c) Heavy water (d) All of them

32. Chemical form of gypsum

(a) $MgSO_4 \cdot 5H_2O$ (b) $CaSO_4 \cdot 2H_2O$
(c) $FeSO_4 \cdot 5H_2O$ (d) $CuSO_4 \cdot 5H_2O$

33. Chemical formula of lime stone is

(a) CaO (b) $Ca(OH)_2$
(c) $CaCO_3$ (d) All of them

34. Gypsum in water is

(a) Sparingly soluble (b) insoluble
(c) Highly soluble (d) None of them

35. Temporary hardness is due to the presence of bicarbonates of

(a) Calcium (b) Magnesium
(c) Both of them (d) None of them

36. The removal of which ion causes water softening

(a) Na^+ (b) Mg^2+
(c) Li^+ (d) K^+

37. Calcium carbonate is in water

(a) Insoluble (b) Sparingly
(c) None of them (d) soluble

38. Temporary hardness in water can be removed by

(a) Boiling Method
(b) Using washing soda
(c) Using Sodium zeolite
(d) All of them

39. Sodium zeolite is naturally occurring reason of

(a) $NaAl(SiO_3)_2$ (b) Na_2CO_3
(c) $CaCO_3$ (d) Na_2SiO_3

40. Hard water can cause

(a) Stomach disorder
(b) Boiler blasts
(c) Inefficiency of engine
(d) All of them

41. Soap is the sodium salt of long chain

(a) Amino acids (b) Fatty acids
(c) Nucleotides (d) None of them

42. Mg^{2+} and Ca^{2+} ions react with soap to form calcium and magnesium salts of fatty acids called

(a) gelatin (b) Scum
(c) Paste (d) None of them

43. Industrial effluents are highly

(a) Toxic organic compounds
(b) Inorganic Salts
(c) Heavy Metals
(d) All of them

44. Which is not a heavy metal?

(a) Cadmium (b) Lead
(c) Zinc (d) Mercury

45. Acute cadmium poisoning causes

(a) High Blood pressure
(b) Kidney damage
(c) Destruction of RBC's
(d) All of them

46. Acute lead poisoning causes dysfunction of

(a) Kidney (b) liver
(c) CNS (d) All of them

47. Neurological damage is caused by the poisoning of

(a) Lead (b) Cadmium
(c) Mercury (d) All of them

48. The salts of which element are present in detergent that causes the rapid growth of algae in water bodies is

(a) Phosphate (b) Calcium
(c) Sodium (d) All of them

49. The depletion of which gas results in the death of aquatic life.

(a) Oxygen (b) Carbon dioxide

(c) Both of them (d) None of them

50. Example of pest is

(a) Weeds (b) Herbs
(c) Insects (d) all of them

51. Which element protects teeth from decay?

(a) Potassium (b) Fluorine
(c) Sodium (d) Calcium

52. Which disease is caused by polluted water?

(a) Cholera (b) Typhoid
(c) Diarrhea (d) All of them

53. Which element do not causes toxicity in water?

(a) Lead (b) Arsenic
(c) Sodium (d) Mercury

54. Vibrious cholera causes

(a) Cholera (b) Dysentery
(c) Fluorsis (d) Hepatitis

55. Which hepatitis is caused by contaminated water?

(a) Hepatitis A (b) Hepatitis B
(c) Hepatitis D (d) Hepatitis C

56. Hookworm infects.

(a) Liver (b) small intestine

(c) Large intestine (d) Stomach

57. Hook worm larvae enter the body through

(a) Food (b) water
(c) Skin (d) All of them

58. A disease is caused by excess of bile pigments in the blood is

(a) typhoid (b) Jaundice
(c) Cholera (d) Dysentery

59. Which organ ceases to function during Jaundice?

(a) Liver (b) Kidney
(c) Stomach (d) large intestine

60. Swimming pools are cleaned by the process

(a) Chlorination
(b) Hydrogenations
(c) None of these
(d) Saponification

61. Chemical formula of hypochlorous acid is

(a) HCl (b) HOCl
(c) H_2CO_3 (d) HF

Answer Key